Physical Properties of Multicomponent Mixtures in a Broad Neighborhood of Their Liquid-Vapor Critical Points

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Phase behavior and some physical properties of binary and ternary fluid mixtures in a broad neighborhood of their liquid-vapor critical points have been studied theoretically and experimentally. In particular, analytical equations for the dew–bubble curves of binary fluids as well as expressions for discontinuities of the isochoric heat capacity $C_{\rho,x}$ and the derivative $(\partial P/\partial T)_{\rho,x}$ at the boundary of the two-phase region have been derived on the basis of the isomorphism theory. The temperature dependence of the discontinuities of the above-mentioned properties in the critical region has also been derived. Moreover, the temperature and density dependence of these discontinuities has been obtained near peculiar points of the dew–bubble curve and of the mixture critical locus. The effect of addition of a third component on these properties has been theoretically analyzed.

Methane-*n*-pentane binary mixtures with certain *n*-pentane concentration (*x)* have been studied experimentally by high-resolution adiabatic calorimetry. The dew–bubble curves as well as the discontinuities of the heat capacity $C_{\rho,x}$ and $(\partial P/\partial T)_{\rho,x}$ have been measured for 1.9, 3.5, and 9.6 mole percents of *n*-pentane. The influence of a third component (nitrogen and *n*-decane) on these physical properties and the shape of the dew-bubble curves have been also investigated. The experimental results obtained are in good agreement with the developed theory.